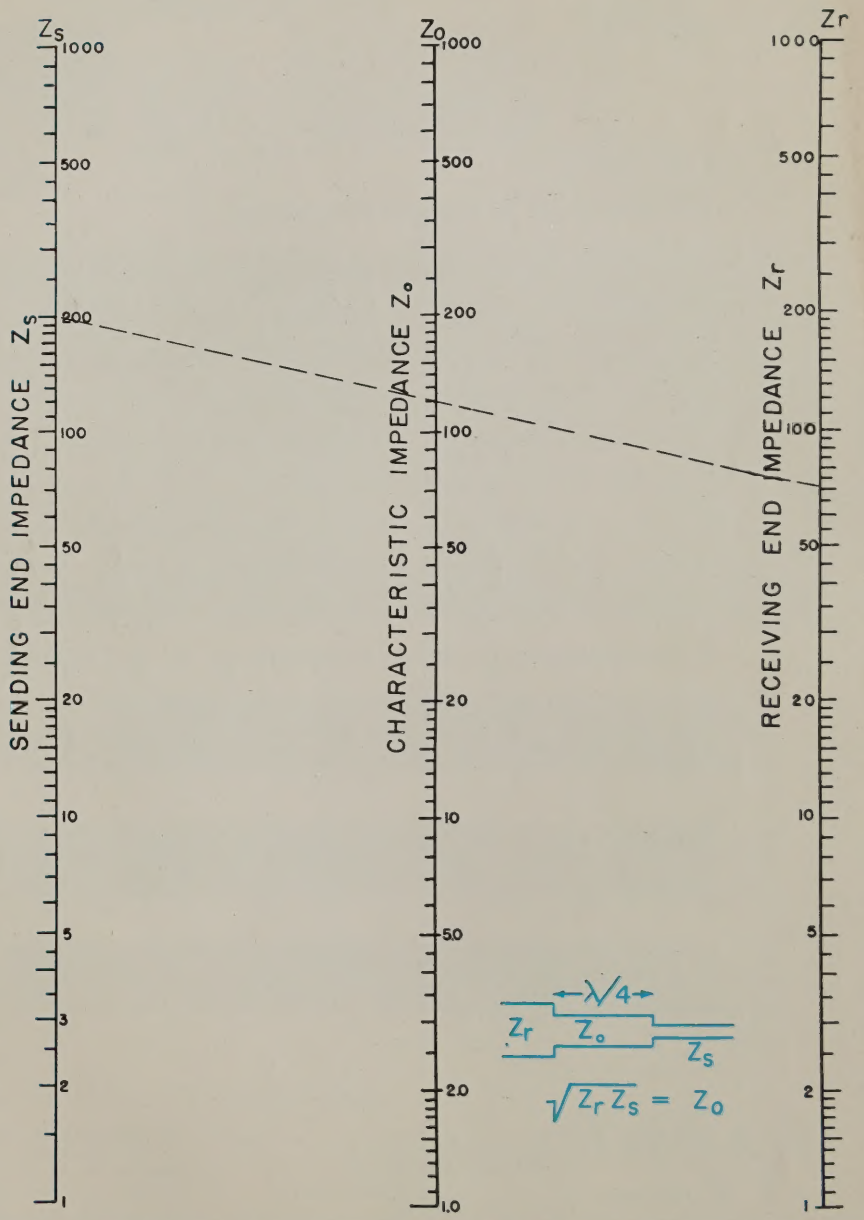
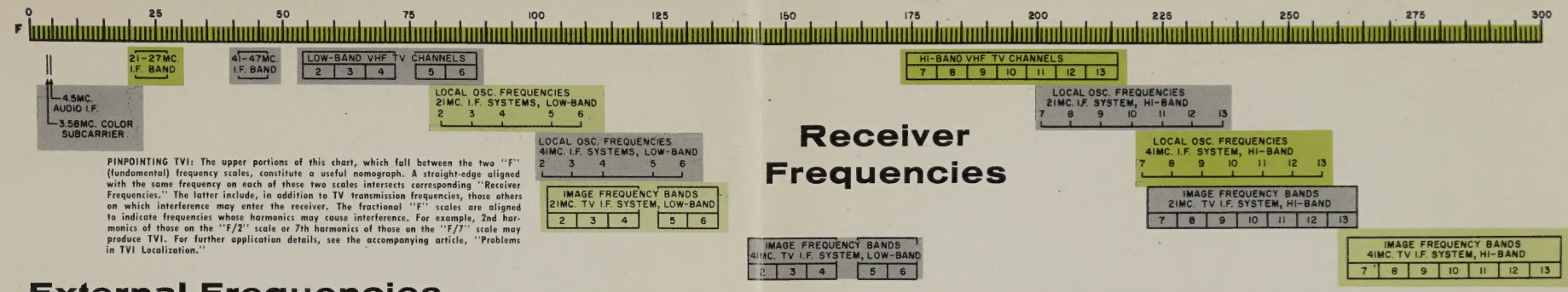
QUARTER-WAVE MATCHING SECTION

This chart is used to obtain the surge impedance of a $\frac{1}{4}\ \lambda$ matching section used as an impedance transformer from one real impedance to another.



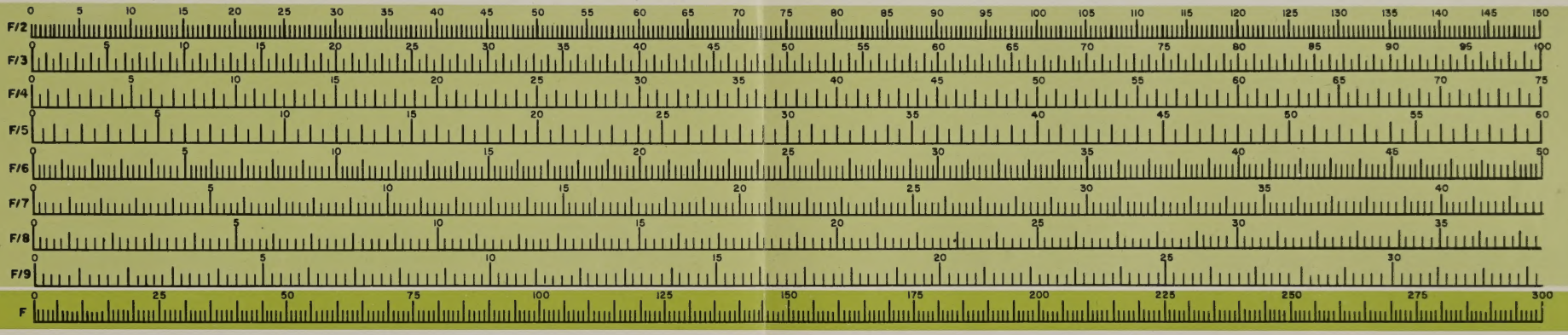
V.H.F. TV Spectrum and Interference Chart



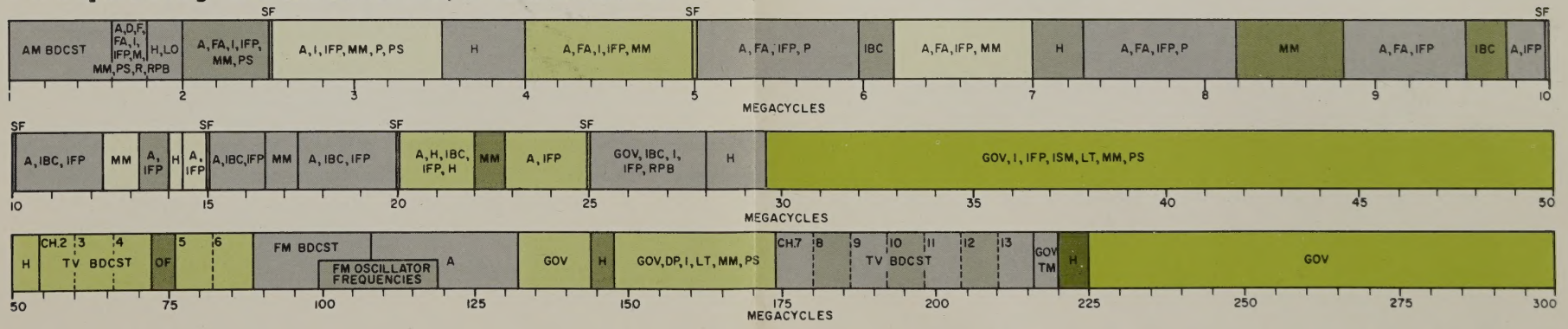
PINPOINTING TVI: The upper portions of this chart, which fall between the two "F" (fundamental) frequency scales, constitute a useful nomograph. A straight-edge aligned with the same frequency on each of these two scales intersects corresponding "Receiver Frequencies." The latter include, in addition to TV transmission frequencies, those others on which interference may enter the receiver. The fractional "F" scales are aligned to indicate frequencies whose harmonics may cause interference. For example, 2nd harmonics of those on the "F/2" scale or 7th harmonics of those on the "F/7" scale may produce TVI. For further application details, see the accompanying article, "Problems in TVI Localization."

Receiver Frequencies

External Frequencies



Frequency Allocations, 1-300 MC.



Key to Abbreviations

- A — Aeronautical, including airdrome control, fixed, mobile, and radionavigation.
- D — Disaster
- DP — Domestic public
- F — Fixed
- FA — Fixed Alaska
- GOV — Government
- H — Amateur
- I — Industrial, including forest products, low power, motion picture, petroleum, r. f. heating, and special industrial.
- IBC — International broadcasting
- IFP — International fixed public
- ISM — Industrial, scientific, medical
- LO — Loran
- LT — Land transportation, including buses, transit, auto emergency, highway trucking.
- M — Mobile
- MM — Maritime mobile, including phone, telegraphy, direction finding, and distress.
- OF — Operational fixed
- P — Police
- PS — Public safety, including fire, forestry, highway maintenance, and emergency.
- R — Radiolocation
- RPB — Remote pickup broadcast
- SF — Standard frequency transmission (WWV)
- TM — Telemetering

RADIO & TV NEWS

ELECTRONICS WORLD

PROBLEMS IN TVI LOCALIZATION

The quantity of information on the accompanying chart covering v.h.f. TV and other radio frequencies will be useful in a variety of applications, including some never considered by the compiler. However, it will be most helpful in solving TV interference problems, for which it was designed.

A major difficulty when TVI occurs is that, out of a seemingly infinite set of paths to pursue, one seldom knows where to begin. Such related but quite separate factors may be involved as the frequency of the interfering source, its nature, its location, the frequency on which it enters the receiver, the portion of the set through which it makes its entry, and the techniques best suited to reducing its effects. Often one of these factors is better to start with than another, but it is seldom easy to tell which at the outset, when this information is most needed. Anything that can narrow down the vast range of possibilities is useful.

No single source can provide quick, ready-made answers. However, when properly applied, the INTERFERENCE CHART can save much time by narrowing down possibilities sharply. It will do this in the majority of cases, although it cannot cover every one of them. Conversely, it will highlight important, additional possibilities that are easily overlooked. But the technician will still have to think.

One of its chief functions is that of determining the frequencies on which the interference may be entering the receiver. The "entering frequency" is not necessarily the same as the frequency of origin, or "source frequency," but must usually be determined first. When either of these is already known, the chart may be used to determine what specific service and/or point of origin is involved. This will be covered later.

Where TVI appears to exist on just one channel, or two, it is still not correct to assume that it is simply entering through the antenna in the r.f. bandwidth of that channel. It may be beating against or near the local-oscillator frequency of the set for that channel. It may be an image, as much above the local oscillator as the received signal is below the latter.

The "source frequency" itself may be some sub-multiple of the one on which TVI is actually entering. For example, a nearby industrial plant may have r.f. heating equipment that operates on 33.5 mc. The eighth harmonic, 268 mc., is an image frequency that may disturb a TV receiver with a 41-mc. i.f. strip when the latter is tuned to receive on channel 7 or 8.

In the matter of harmonic interference, it is recognized that requirements for suppressing harmonic radiation are fairly rigid. Even so, harmonic interference is easily produced in the receiver itself. Take the case just mentioned. The heating equipment in the nearby plant may put out a very "clean" 33.5-mc. However, TV tuner circuits are quite non-linear. They can act as excellent harmonic generators for an entering 33.5-mc. or other signal, especially if that signal is strong enough to cause overload. Nevertheless, the cure involves suppression of the fundamental.

The source of interference may be the TV receiver itself, with one circuit providing unwanted signal for another. As a corollary, one TV receiver may be the interference generator for another, especially if they or their antennas are adjacent, or if they are fed by a common signal distribution system.

For example, the video detector (a nonlinear circuit element) has been known to act as a harmonic generator for signals within the i.f. bandwidth that are fed to it. Thus the 4th or higher harmonics of 41-47 mc. i.f. signals can interfere with reception on channels 7 to 13. Also the 13th harmonic (46.54 mc.) of the subcarrier oscillator (3.58 mc.) in some color sets has been known to interfere on all channels of its own or nearby receivers.

Whenever interference appears to exist on many or all channels received, instead of one or two, the probability is that entrance is through the fixed-tuned circuits (video i.f. for picture hash, audio i.f. for garbled sound, 3.58-mc. oscillator for loss of color sync or color). This fact is helpful in determining the portion of the receiver that is affected. While antenna and r.f. circuits are thought of as the most susceptible points of entry, no possibilities should be overlooked. In addition to those already noted, there is always the power line.

How to Use the Chart

To identify probable "source" frequencies of TVI, locate the possible "entrance" frequencies on that portion of the chart marked below as "A" ("Receiver Frequencies"). Using the two "F" scales, align a straight edge so that it intersects the possible entering frequencies, working with one such frequency at a time. (Refer to the note entitled PINPOINTING TVI in the upper portion of the chart.)

"Source" frequencies whose fundamentals or harmonics may be suspect will be intersected on the intermediate scales (F, F/2, etc., in section "B"). Although harmonics above the 20th have been known to result in TVI, the most likely ones are given by the chart. Subharmonics up to the 10th may be found mentally by moving the decimal point one place to the left on the "F" scale.

The "Allocations" portion of the chart (section "C" below) is then used to see what interfering services may be involved, between 1 and 300 mc., as indicated on the "F" scales. While this may still leave numerous possibilities, common sense and slight effort will provide further, drastic narrowing down. Few of the indicated services are likely to be possibilities in any one area. For example, there is little likelihood of TVI from maritime services in an inland location. Away from airports or airlanes, this source can be ignored. A check with the regional office of the FCC will assist in determining what services are active in a given area and what frequencies they use.

Remembering that the receiver itself or other sets may be implicated, the cautious technician will examine section "A" of the chart for sources at the same time that he uses section "C."

In another application of the locator chart, let us assume that the source and originating frequency are already known. For example, the transmission is readily identifiable as originating from a local airport. To apply proper suppression, we must determine how the interference enters the TV receiver. We now start out with the known frequency, on the "F" and fractional "F" scales in section "B," and determine entering frequencies in section "A."

Since it is not a magic wand, the locator chart is intended to supplement rather than replace other known weapons in the war against TVI. Such devices as interference probes will still be useful. Knowledge of available types of interference filters and their uses, as well as data for fabricating them, is still essential. Also, nothing can replace the ability to think.